

**UNIVERSITY OF MAINE AT FARMINGTON**

**COLLEGE OF EDUCATION, HEALTH AND REHABILITATION**

**LESSON PLAN FORMAT**

Teacher’s Name: Ms. Turner **Lesson #:** 1 **Facet:** Application  
**Grade Level:**9-11 **Numbers of Days:** 3-4  
**Topic:** Quadratic equations and graphs  
  
**PART I:**  
**Objectives**  
Students will understand that there are multiple was to solve a quadratic equation for an unknown variable.  
Student will know equation, variable, degree, coefficient, constant, parabola, quadratic, ax^2+bx+c  
Student will be able to solve a quadratic equation.  
Product: Google Docs  
  
**Maine Learning Results (MLR) or Common Core State Standards (CCSS) or Next Generation Science Standards (NGSS) Alignment**  
**Common Core State Standards**  
**Content Area**: Algebra  
**Grade Level**: High school  
**Domain**: Reasoning with Equations and Inequalities  
**Cluster**: Solve equations and inequalities in one variable  
**Standard** 4: Solve quadratic equations and in one variable.  
**Rationale:** The teacher will introduce quadratic equations, how they are represented in both equations and graphs.  
  
**Assessments  
Pre-Assessment: (Lesson 1 only)**  
Students will fill out a survey that consists of test like questions to assess how much knowledge of quadratics students are starting with.  
**Formative (Assessment for Learning)**  
**Section I – checking for understanding strategy during instruction**  
The teacher will use 4-3-2-1 half way through the lesson to assess how students feel they are grasping the concept. Students will be given a simple quadratic equation to solve that will be their exit ticket to leave class that day. This will allow the teacher to assess if the students are grasping the concept or not  
**Section II – timely feedback for products (self, peer, teacher)**The teacher will leave comments on students google doc for timely feedback on how they solved the equations. Students will reflect on the equations they solved and email the reflection to the teacher.  
**Summative (Assessment of Learning):**  
Students will create a google doc and create three quadratic equations. Students will share this document with the class and give each classmate the ability to edit the document. Each student will be responsible for solving one equation from three different students. They will put only their answers on the corresponding google doc. Students will also bring the work they did to get the answer into class to turn into the teacher.  
**Integration  
Technology (SAMR):**   
The use of google docs in this lesson is at the augmentation level because students will be required to share their document, where they created their three equations, with every student in the class.  
**Content Areas:**

**History:** The teacher will give a brief history on the first credited mathematician demonstrating quadratics. 

**Groupings  
Section I - Graphic Organizer & Cooperative Learning used during instruction**  
Students will fill out a KWL to assess their knowledge on quadratic equations. Students will work together and perform a pair’s check to have practice solving quadratic equations and helping others solve quadratic equations.  
**Section II – Groups and Roles for Product**  
Students will work individually to create their own quadratic equations and google doc. Students will be assigned an equation from three different students to solve their equations, they will share this with the group in class.  
  
Differentiated Instruction  
MI Strategies  
**Verbal:** After students solve three other students quadratic equations they will email feedback to the teacher on how they feel they are doing.  
**Logic:** Students will use logic and what they have learned to create their own quadratic equations.  
**Visual:** The teacher will have pictures of graphs and equations available for use in and out of the classroom.  
**Kinesthestic:** After introducing quadratic graphs, students will use their bodies to demonstrate the graphs.  
**Intrapersonal:** Students will work by themselves to create to their own quadratic equations and post them to a google doc  
**Interpersonal:** Students will look at other students equations on google docs and solve three different equations.  
  
**Modifications/Accommodations  
*From IEP’s ( Individual Education Plan), 504’s, ELLIDEP (English Language Learning Instructional Delivery Education Plan)****I will review student’s IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*

**Plan for accommodating absent students:**If a student is absent at any point during this lesson, it is the students responsibility to check the teachers online website for what was discussed in class. If the student is absent on a day when the google docs product is introduced the student must check the teachers online website and speak to the teacher about the product. If a student misses more than one class during this time the student will receive an alternate assignment agreed upon by the student and teacher

**Extensions  
Technology (SAMR): Gifted Students:**  
To reach the modification level for this lesson students will use Geogebra to include graphs with their equations.  
  
**Materials, Resources and Technology**

* Projector
* Graphing calculator
* Textbooks
* Worksheets
* Handout- Google doc instructions
* Different colored markers
* laptops for students
* Graphic organizer

**Source for Lesson Plan and Research**  
<http://www.eduplace.com/graphicorganizer/-> A great website to find many different graphic organizers.  
<http://cpm.sweetwaterschools.org/files/2013/02/Strategies-A-Z.pdf-> A list of multiple strategies to check for understanding from your students.  
<http://www.ode.state.or.us/opportunities/grants/nclb/title_iii/5cooperative-learning-strategies.pdf-> Different cooperative learning strategies for teachers to use to help students.  
<http://www.gcflearnfree.org/googledocuments-> This site explains all aspects of Google docs, including picture diagrams for maximum understanding.  
<https://docs.google.com/document/u/0/-> Used for assignment where students will post equations and look at other students equations  
<http://www.algebra.com/algebra/homework/quadratic/VIDEO%3A-An-Introduction-to-Quadratic-Functions.lesson-> This video gives a good explanation of quadratics and the difference between linear and quadratic equations.  
<http://www.shelovesmath.com/algebra/intermediate-algebra/quadratics/-> This website offers some further explanation on quadratic equations, specifically graphing the equations.  
<http://www.math.com/school/glossary/glossindex.html-> Website for mathematical vocabulary.  
<https://youtu.be/E_0AHIaK48A>- Super Mario hook video.  
  
**PART II:**  
**Teaching and Learning Sequence**   
  
In the classroom, desks will be arranged in three rows of two facing the whiteboard. This will allow students to work with a partner easily when needed, and will also make it easy for the teacher to check in individually with students. The teacher’s desk will be placed at the back of the room to maximize privacy for students needing extra help, while also allowing the teacher to watch over all students.  
  
**Agenda:**  
**Day one:**  
1) Pre-assessment (15 minutes)  
2) Hook (video) (5 minutes)  
3) Syllabus (5 minutes)  
4) Introduction to what a quadratic equation is ( 40 minutes)  
5) Wrap up/ homework  
Assignment: Fill out KWL sheet and bring it to the next class to discuss similarities with other students.  
  
**Day Two:**  
1) Discussion of KWL (15 minutes)  
2) Introduce quadratic graphs (30 minutes)  
3) 4-3-2-1 check and discussion (10 minutes)  
4) Introduction to google docs (15 minutes)  
5) Wrap up/homework  
Assignment: create a google plus account if you do not have one. Create a google document and share it with the teacher. Bring any problems/complications to class to discuss.  
  
**Day Three:**  
1) Problems with Google docs (5 minutes)  
2) Clarification on quadratic equations and how to create your own (45 minutes)  
3) Pick groups for homework (10 minutes)  
4) How to input equation into google doc (10 minutes)  
5) Wrap up/ homework/ exit ticket (10 minutes)  
Assignment: Create a google doc, create three equations and post them on the google doc two equations will be quadratics and one will be linear. Share the document with the other people in your group. Look over the equations from the other people in your group. Decide which two are quadratic and which one is linear. Bring answers to class to discuss.  
  
**Day Four:**  
1) Meet with groups to discuss homework problems ( 25 minutes)  
2) Discuss problems as a class (25 minutes)  
3) Final discussion/ clarification on how to identify quadratic equations (20 minutes)  
4) Wrap up/ sneak preview of next unit/(10 minutes)  
  
**Teaching and Learning Sequence**   
Students will understand that there are multiple was to solve a quadratic equation for an unknown variable. Quadratic equations can be used to find many things such as the path of a ball that was thrown, or calculating speed.  
*4: Solve quadratic equations and in one variable.* .  
Students will fill out a survey that consists of test like questions to asses how much knowledge of quadratics students are starting with.  
The teacher will play a video that shows what a quadratic is and how it is different from a linear equation. The video is based on parabolas in the video game Super [Mario](https://www.youtube.com/watch?v=E_0AHIaK48A&feature=youtu.be), this will interest students by relating the topic to a real life situation that students will enjoy.  
**Where, Why , What, Hook Tailors: *Verbal, logic, visual, kinesthestic, intrapersonal, interpersonal***  
  
The students first will be presented with a linear equation and a graph of a line. The teacher will review words such as equation, variable, degree, coefficient and constant. The teacher will show students each part of the equation on a linear equation and than a quadratic equation to compare and contrast them. The teacher will introduce new words to students [vocabulary](http://www.math.com/school/glossary/glossindex.html) such as parabola, quadratic, and standard form. Students will fill out a[KWL](http://www.eduplace.com/graphicorganizer/) to assess their knowledge on quadratic equations and to get them thinking about what we will uncover with this unit. The teacher will be able to use this information to help keep students interested in the material. The teacher will regularly use [4-3-2-1](http://cpm.sweetwaterschools.org/files/2013/02/Strategies-A-Z.pdf) to be sure that students are following the material. Students will work with a partner on a hand out that has a mix of linear and [quadratic](http://www.algebra.com/algebra/homework/quadratic/VIDEO%3A-An) equations and [graphs](http://www.shelovesmath.com/algebra/intermediate-algebra/quadratics/). Students must decide which is which and label them as such. This allows students to work with a partner to have practice in recognizing quadratic equations. After students complete their Google docs assignment they will email the teacher to check in a let them know how they are doing and if they still have any questions or uncertainties.  
Students will reflect on the equations they solved and email the reflection to the teacher  
**Equip, Explore, Rethink, Tailors:** ***Visual, Verbal, Logic, Interpersonal, Intrapersonal***  
  
The students will be able to identify quadratic equations and their graphs, and create their own. The students [Google docs](https://docs.google.com/document/u/0/) assignment will give them further practice with equations as well as technology. The teacher will provided a [tutorial](http://www.gcflearnfree.org/googledocuments)in class and will also provide a website that has instructions for google docs. The teacher will be able to see all students equations on google docs and will be able to provide feedback for the students to ensure their understanding. Students will have the chance to have first hand experience at creating their own equations and identifying quadratic equations. Students will have the opportunity to do some of the assignment alone, and some of the assignment in a group. Students will be put into groups of 3-4 students, each student will create three of their own equations, 2 quadratic and 1 linear. Students will look at the equations posted by the others in their group and identify the quadratic equations. Students will do this for homework, the next day in class [groups](http://www.ode.state.or.us/opportunities/grants/nclb/title_iii/5cooperative-learning-strategies.pdf) will get together to discuss the work. Each student will email the teacher after completing the assignment to let them know how they are feeling about quadratics and if they still have any questions or uncertainties. Students will also have the chance to check in with peers and collaborate on identifying different equations.  
**Experience, Revise, Refine, Tailors: *Verbal, Logic, Visual, Kinesthestic, Intrapersonal, Interpersonal***  
  
The teacher will be able to go onto the students google doc and comment on their work. Students will be able to see this instantly thus getting feedback quickly. The product will mainly be graded on effort, if the teacher see's that the student put in a good effort and responded to all group members’ equations they will receive full credit. This information leads directly into our next lesson of solving quadratic equations. Students will need to have mastered identifying quadratics so we can then move onto solving equations.  
**Evaluate, Tailors: *Visual, Logic, Interpersonal***  
  
**Teacher Content Notes**   
**Vocabulary students will know:**  
**Equation:** a statement that the values of two mathematical expressions are equal.  
**Variable:** able to assume different numerical values.  
**Degree:** the class into which an equation falls according to the highest power of unknowns or variables present  
**Coefficient:** a numerical or constant quantity placed before and multiplying the variable in an algebraic expression  
**Constant:** a quantity or parameter that does not change its value whatever the value of the variables, under a given set of conditions.  
**Parabola:** a symmetrical open plane curve formed by the intersection of a cone with a plane parallel to its side. The path of a projectile under the influence of gravity ideally follows a curve of this shape.  
**Standard form:** ax^2+bx+c.  
The teacher will have Geogebra open to show students different graphs. The teacher will show the equations y=2x+5 and y=x^2. The teacher will ask students what they think is different between the two graphs. What could be causing the second graph to look the way that it does? What does this mean for the actual equation. The teacher will show that the parabola is curved because the variable is being squared thus having 2 x-values for each y-value. The teacher will show different quadratic equations such as 2x^2+4x+8=0, 6x-8x^2+10=0, 2x-x(6-x)+9. The teacher will discuss each equation with the students and what makes it a quadratic equation. Students will be given a KWL sheet for homework to help them expand on the ideas we went over in class and to get them thinking about what they want to uncover in this unit.  
The teacher will take time to discuss students KWL and see if there are any similarities between students. The teacher will then go into depth on graphing and how to graph quadratic equations. After this explanation the teacher will do a 4-3-2-1 check to be sure that students are understanding the material and to see if there are any concepts they need to go over again. The teacher will pair students up based on their answers to do a worksheet that gives examples of different linear and quadratic equations. Students will have to work together to identify which is which. The teacher will introduce google docs and show the students how to use it. For homework students will need to create a google docs account, create a document and share it with the teacher. If there are any problems the student should email the teacher and they will go over them in the next class.  
The teacher will answer any questions the students have with creating documents or getting set up on Google docs. The teacher will ask for any clarifying questions the students still have about quadratic equations. The teacher will spend time going over how to create your own quadratic equation and what makes a good quadratic equation. Once the teacher feels the students have a good understanding the teacher will put students into groups for their upcoming assignment. The class will then go over how to input equations into google docs, and what to do if you cannot remember how to input the equations. The teacher will give the students an exit ticket so they can assess how they think students are doing and get a feel for how the assignment is going to go.  
The students will get into their groups and discuss their equations, how they identified others equations, and if they had any problems. The students will give feedback to the teacher to how they think the assignment went and if they feel that it helped them in any way. The class will talk about the equations as a whole, if the teacher found one particularly good they will share it with the class and discuss the equation. Students will have a chance to ask any last minute clarifying questions to ensure that they do fully understand the material. The teacher will then give a brief introduction to the next lesson and let students know what they can look forward to in days to come.  
  
**Handouts**

* Worksheets
* Handout- Google doc instructions
* Graphic organizer

**Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale**  
***Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences****.*  
  
***Learning Styles***  
***Clipboard:*** *The teacher will have a website that has the class calendar on it that gives a brief overview of what was done in class. The any handouts given will be linked to the site as well as all homework assignments listed. Any and all assignment expectations or rubrics will be posted as well.*  
  
***Microscope:*** *Students will take part in creating their own equations, thus having to have a deep understanding of the material. This will also allow students to really have to analyze their own quadratic equations as well as other classmates.*  
  
***Puppy:*** *The teacher will ensure that students feel comfortable in the classroom. The teacher will encourage students to try to answer questions and will support students giving incorrect answers.*  
  
***Beach Ball:*** *The teacher will allow students to be creative and create their own equations for the assignments. This allows students to have personal freedom with their equations to create something they want.*  
  
***Rationale:*** *This lesson incorporates many different aspects that allow students of different learning styles to best benefit from the lesson. By keeping the lesson diverse the teacher is able to help the most amount of students succeed.*  
  
***Standard 6 -* *Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.***  
***Formative:*  
Section I – checking for understanding strategy during instruction**  
The teacher will use 4-3-2-1 half way through the lesson to assess how students feel they are grasping the concept. Students will be given a simple quadratic equation to solve that will be their exit ticket to leave class that day. This will allow the teacher to assess if the students are grasping the concept or not  
**Section II – timely feedback for products (self, peer, teacher)**  
The teacher will leave comments on students google doc for timely feedback on how they solved the equations. Students will reflect on the equations they solved and email the reflection to the teacher.  
  
***Summative:***  
Students will create a google doc and create three quadratic equations. Students will share this document with the class and give each classmate the ability to edit the document. Each student will be responsible for solving one equation from three different students. They will put only their answers on the corresponding google doc. Students will also bring the work they did to get the answer into class to turn into the teacher.  
  
***Rationale:***These assessments all the teacher to be sure that students are truly understanding the material. The assessments still take into account all different types of learning styles and allows all students to showcase their knowledge.  
  
***Standard 7* - *Planning Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.***  
***Content Knowledge:***Students will know equation, variable, degree, coefficient, constant, parabola, quadratic and standard form (see content notes)  
  
***MLR or CCSS or NGSS***  
**Common Core State Standards**  
**Content Area**: Algebra  
**Grade Level**: High school  
**Domain**: Reasoning with Equations and Inequalities  
**Cluster**: Solve equations and inequalities in one variable  
**Standard** 4: Solve quadratic equations and in one variable.  
b: Solve quadratic equations by inspection (e.g., for x^2=49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a+-bi for real numbers a and b.  
  
***Facet:*** *Application*  
  
***Rationale:***Students will be introduced to quadratic equations. They will understand how they differ from linear equations and what their graphs look like. They will understand standard form and how to set up quadratic equations*.*  
  
***Standard 8 -* *Instructional Strategies.*** *The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.*  
  
***MI Strategies:***  
**Verbal:** The teacher will explain to students the difference between linear and quadratic equations.  
**Logic:** The students will need to analyze different equations and decide which ones are quadratic.  
**Visual:** Students will be able to see quadratic graphs to further their understanding.  
**Kinesthetic:** The teacher will have students work in pairs to identify quadratic equations, this includes looking at different equations and graphs that are posted around the room.  
**Intrapersonal:** The students will have to create quadratic equations on their own for their assignment.  
**Interpersonal:** Students will work in groups to discuss their equations and how they identified others equations.  
  
***SAMR:*** *Google docs is at the modification level. Students are able to electronically write down their equations, they are then able to share them with other students who can instantly work on them. This makes collaborating and working on assignments much easier for students.*  
  
***Rationale:*** *By having students share their equations with others on Google docs it is immersing them in a technology that allows students to really be connected with other students. It also allows students to instantly get feedback from the teacher.*  
  
***NETS STANDARDS FOR TEACHERS*  
1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.**a. Promote, support, and model creative and innovative thinking and inventiveness  
  
b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources  
  
c. Promote student reflection using collaborative tools to reveal and clarify students’ conceptual understanding and thinking, planning, and creative processes  
  
d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments  
  
***Rationale:*** *a,c, and d. By having students create their own equations the teacher is helping the students be creative and make something of their own. Students have the opportunity to use innovated technology virtually and face-to-face by sharing their google docs and discussing them with others in class.*  
  
**2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S**.  
a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity  
  
b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress  
  
c. Customize and personalize learning activities to address students’ diverse learning styles, working strategies, and abilities using digital tools and resources  
  
d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching  
  
***Rationale:*** *a,b,c, and d. The teacher gives the students the opportunity to take their thinking beyond a normal worksheet. By allowing students to create their own equations and share them virtually with other students it allows students with different learning styles to get something out of the assignment.*